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C-A OPERATIONS PROCEDURES MANUAL

# 2.39 Response to a Ground Fault Alarm at C-AD

Text Pages 2 through 5

Hand Processed Changes

| HPC No. | Date | Page Nos. | Initials |
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Collider-Accelerator Department Chairman Date

J. Sandberg

## 2.39 Response to a Ground Fault Alarm at C-AD

### 1. Procedure

This procedure provides instructions to C-A Operations and Power Distribution Group personnel for responding to a Ground Fault on the C-AD 480 Volt (Delta Secondary) power distribution system.

### 2. Responsibility

2.1 The Operations Coordinator or his designee during operations period or the CAS watch during shutdowns periods is responsible for executing portions of this procedure and ensuring all operations personnel are trained in the application of this procedure. Operations personnel shall be trained in recognizing ground fault alarms and reporting them to the responsible personnel in the C-AD Power Distribution Group.

2.2 The Power Distribution Group Leader is responsible for executing portions of this procedure and ensuring power distribution personnel are trained in the application of this procedure.

2.3 The Power Distribution Group Leader is responsible for informing the C-AD Chief Electrical Engineer of the existence of a ground fault within eight hours of its discovery.

2.4 The Power Distribution Group Leader, Operations Coordinator, or CAS Watch shall be responsible for informing those groups who may operate equipment affected by the ground fault of its existence. If applicable the Building manager shall also be notified.

2.5. The Power Distribution Group Leader and Operations Coordinator shall be responsible for informing those groups who may operate equipment affected by the ground fault when it is removed. If applicable the Building manager shall also be notified.

2.6 C-AD Group Personnel who operate and maintain equipment affected by a ground fault are required to be familiar with this procedure.

2.7 The line crew or electricians who perform substation inspection shall be responsible for informing the Power Distribution Group Leader of possible ground faults uncovered while reading local substation metering.

2.8 The Power Distribution Group Leader shall inform Plant Engineering of a ground fault at a C-AD substation.

## 3. Prerequisites

None

## 4. Precautions

4.1 The C-AD power distribution system (Delta Secondary) for experimental and high power equipment is either ungrounded or grounded through a high resistance. In the event of a single line to ground fault, little or no fault current will flow and the electrical system can continue to operate in a normal fashion until the fault can be isolated and removed.

4.2 If a second phase of the distribution system faults to ground a line to ground to line fault will occur and large fault currents will flow. This can be very dangerous to both personnel and equipment. This is a similar to what would happen in a solidly grounded system if a single line to ground fault occurred.

4.3 The normal voltages to ground on the C-AD 480 volt system is 277 volts. If one phase is grounded the voltage will redistribute and two phases will rise to 480 volts to ground, while the grounded phase will be zero volts to ground. This situation does not present a safety concern but may stress insulation and reduce equipment lifetime.

4.4 If an arcing ground exists the voltage on the system may rise to several thousand volts. This could present a danger to personnel and equipment. It may therefore be important to measure the system voltages when a ground fault exists. Any such measurement shall be done with a proper work plan and shall be approved by the Power Distribution Group leader or C-AD Chief EE.

## 5. Procedure

5.1 Ground faults at C-AD are remotely monitored and alarmed in the MCR. When a ground fault alarm is detected in the MCR the MCR operator or CAS Watch shall immediately inform the head of the C-AD Power Distribution Group or his designee.

5.2 The Head of the Power Distribution Group (PDGH), the Operations Coordinator, or the Maintenance Coordinator, and the CAS Watch, shall determine the groups affected by the ground fault and the affected personnel shall be notified of the condition.

5.2.1 Notification will include (but not be limited to) a posting on the CATV/RHIC_Broadcast system.

5.2.1.1 During operating periods the PDGH will instruct the OC to post the location of the ground fault, the affected systems, and/or the affected personnel on the CATV/RHIC_Broadcast.

5.2.1.2 During shutdown periods the PDGH will instruct the Maintenance Coordinator to post the location of the ground fault, the affected systems, and/or the affected personnel on the CATV/RHIC_Broadcast.

5.3 Voltage imbalances may be found during routine substation inspections. These imbalances may indicate a partial ground fault not severe enough to be picked up by the remote ground fault monitoring system.

5.4 Power Distribution Group Personnel or their Designees shall determine if an over voltage condition exists on the system. An over voltage shall be defined as a voltage greater than 500 V to ground on any phase.

5.4.1 If an over voltage condition exists, the Head of the Power Distribution Group or his designee shall inform the Operations Coordinator and the affected bus shall immediately be put out of service until the ground fault can be repaired.

5.4.2 If an over voltage condition exists, a plan to isolate the faulted section of the system shall be formulated by the Head of the Power Distribution Group and reviewed by the Chief EE. This plan shall include a list of the proper PPE required to work on the system.

5.5 If an over voltage is not detected, operations may continue on the affected bus until an orderly shutdown and transition into a maintenance period can be performed. The length of time such operations are permitted for shall be determined by the Chief Electrical Engineer, the Head of the C-AD Power Distribution Group, and the Department ESH Coordinator. The plans shall include a schedule documenting when the system will be repaired.

5.6 Every effort shall be made by the Power Distribution Group, in coordination with the MCR and CAS Watch, to isolate and repair the grounded bus as soon as possible.

5.7 During the period of time the ground fault exists switching operations shall be minimized on the affected systems and all such operations shall be done under an enhanced work permit which addresses the concerns of working while a ground fault exists.

5.8 All electrical work done on the portion of the system that has the ground fault will require an enhanced work permit addressing the concerns of working while a ground fault exists.

5.9 The PPE required to operate electrical equipment is not affected by the status of the system grounds. However, in some cases the PPE class for an operation is reduced by one hazard category due to a closed cover or similar barriers. When operations are done with a known ground fault present no such reduction is allowed.

## 6. Documentation

6.1 The date and time of the fault shall be recorded by the CAS Watch.

6.2 The system voltages shall be measured and recorded by the Power Distribution Group.

6.3 A memo by the Chief Electrical Engineer shall be written documenting the decision to operate with the ground fault in place and the length of time such operations may take place.

6.4 The Head of the Power Distribution Group shall write a memo to the Chief Electrical Engineer explaining how the ground fault was eliminated.

6.5 Substation inspection reports

## 7. References

7.1 C-A-OPM 16.2.2, "C-AD Substations Inspection Procedure".

## 8. Attachments

None